

Docket No. 239512US0CONT



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: Takashi OKAZOE, et al.

SERIAL NO: 10/619,784

GAU:

FILED: July 16, 2003

EXAMINER:

FOR: PROCESSES FOR PRODUCING A FLUORINATED ESTER, A FLUORINATED ACYL FLUORIDE AND A FLUORINATED VINYL ETHER

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR 1.97

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

Applicant(s) wish to disclose the following information.

REFERENCES

- The applicant(s) wish to make of record the references listed on the attached form PTO-1449. Copies of the listed references are attached, where required, as are either statements of relevancy or any readily available English translations of pertinent portions of any non-English language references.
- A check is attached in the amount required under 37 CFR §1.17(p).

RELATED CASES

- Attached is a list of applicant's pending application(s) or issued patent(s) which may be related to the present application. A copy of the patent(s), together with a copy of the claims and drawings of the pending application(s) is attached along with PTO 1449.
- A check is attached in the amount required under 37 CFR §1.17(p).

CERTIFICATION

- Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement.
- No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application or, to the knowledge of the undersigned, having made a reasonable inquiry, was known to any individual designated in 37 CFR §1.56(c) more than three months prior to the filing of this statement.

DEPOSIT ACCOUNT

- Please charge any additional fees for the papers being filed herewith and for which no check or credit card payment form is enclosed herewith, or credit any overpayment to deposit account number 15-0030. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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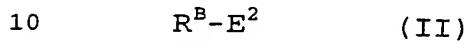
LIST OF RELATED CASES

<u>Docket Number</u>	<u>Serial or Patent Number</u>	<u>Filing or Issue Date</u>	<u>Inventor/ Applicant</u>
237014US0 CONT	10/421,924	04/24/03	OKAZOE, et al.
239512US0 CONT*	10/619,784	07/16/03	OKAZOE, et al.

*Present Application; listed for information

WHAT IS CLAIMED IS:

1. A process for producing a fluorine-containing compound, which comprises reacting the following compound (I) with the following compound (II) to form the following compound (III), fluorinating the compound (III) in a liquid phase to form the following compound (IV) and then converting the compound (IV) to the following compound (V) and/or the following compound (VI):



15 wherein R^A , R^B : each independently is a monovalent saturated hydrocarbon group, a halogeno monovalent saturated hydrocarbon group, a hetero atom-containing monovalent saturated hydrocarbon group, a halogeno(hetero atom-containing monovalent saturated hydrocarbon) group, or a monovalent organic group (R^H) which can be converted to R^{HF} by a fluorination reaction in a liquid phase, R^{HF} : a group having at least one hydrogen atom in a group selected from a monovalent saturated hydrocarbon group, a partially halogeno monovalent saturated hydrocarbon group, a hetero atom-containing monovalent saturated hydrocarbon group and a partially halogeno(hetero atom-containing monovalent hydrocarbon)

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group, substituted by a fluorine atom;

R^{AF} , R^{BF} : R^{AF} is a group corresponding to R^A , and R^{BF} is a group corresponding to R^B ; and in a case where each of R^A and R^B is a monovalent saturated hydrocarbon group,
5 a halogeno momovalent saturated hydrocarbon group, a hetero atom-containing monovalent saturated hydrocarbon group, or a halogeno(hetero atom-containing saturated hydrocarbon) group, R^{AF} and R^{BF} are the same groups as R^A and R^B , respectively, or groups having at least one
10 fluorine atom present in the groups of R^A and R^B substituted by a fluorine atom, and in a case where R^A and R^B are monovalent organic groups (R^H), R^{AF} and R^{BF} are R^{HF} , respectively;

E^1 , E^2 : reactive groups which are mutually reactive
15 to form a bivalent connecting group (E);

E: a bivalent connecting group formed by the reaction of E^1 and E^2 ;

E^F : the same group as E, or a group having E fluorinated, provided that at least one of R^{AF} , R^{BF} and E^F ,
20 is not the same group as the corresponding R^A , R^B and E, respectively;

E^{F1} , E^{F2} : each independently is a group formed by dissociation of E^F .

2. The process according to Claim 1, wherein the
25 fluorine content in the compound (I) is less than 10 mass%, and the fluorine content in the compound (III) is at least 10 mass%.

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3. The process according to Claim 1, wherein the molecular weight of the compound (III) is from 200 to 1,000.

4. The process according to Claim 1, wherein the 5 fluorine content of the compound (III) is from 10 to 86 mass%.

5. The process according to Claim 1, wherein R^B is R^{BF}.

6. The process according to Claim 1, wherein each of R^{AF} and R^{BF} is a perfluoro monovalent saturated hydrocarbon 10 group, a perfluoro(partially halogeno monovalent saturated hydrocarbon) group, a perfluoro(hetero atom-containing monovalent saturated hydrocarbon) group, or a perfluoro[partially halogeno(hetero atom-containing monovalent saturated hydrocarbon)] group.

15 7. The process according to Claim 1, wherein the compound (V) has the same structure as the compound (VI).

8. The process according to Claim 1, wherein the compound (II) has the same structure as the compound (VI).

9. The process according to Claim 1, wherein the 20 compound (V) has the same structure as the compound (VI) and the same structure also as the compound (II).

10. The process according to Claim 8, wherein a part or whole of the compound (VI) formed by the conversion of the compound (IV) is used again for the reaction with the 25 compound (I).

11. The process according to Claim 1, wherein the compound (I) is the following compound (Ia), the compound

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(II) is the following compound (IIb), the compound (III) is the following compound (IIIC), the compound (IV) is the following compound (IVd), the compound (V) is the following compound (Ve), and the compound (VI) is the following compound (VIIf), provided that R^A , R^B , R^{AF} and R^{BF} have the same meanings as the meanings in Claim 1, and X is a halogen atom:

5 $R^A\text{CH}_2\text{OH}$ (Ia)
 10 XCOR^B (IIb)
 10 $R^A\text{CH}_2\text{OCOR}^B$ (IIIC)
 10 $R^{AF}\text{CF}_2\text{OCOR}^{BF}$ (IVd)
 10 $R^{AF}\text{COF}$ (Ve)
 10 $R^{BF}\text{COF}$ (VIIf)

12. The process according to Claim 11, wherein X is a
 15 fluorine atom.

13. The process according to Claim 11, wherein R^{AF} and R^{BF} have the same structure.

14. The process according to Claim 11, wherein the
 compound (Ia) is the following compound (Ia-2), the
 20 compound (IIb) is the following compound (IIb-2), the
 compound (IIIC) is the following compound (IIIC-2), the
 compound (IVd) is the following compound (IVd-2), the
 compound (Ve) is the following compound (Ve-2), and the
 compound (VIIf) is the following compound (IIb-2):

25 $R^1\text{CH}_2\text{OH}$ (Ia-2)
 25 FCOR^2 (IIb-2)
 25 $R^1\text{CH}_2\text{OCOR}^2$ (IIIC-2)

$R^3CF_2OCOR^2$ (IVd-2)

R^3COF (Ve-2)

wherein R^1 : an alkyl group, an alkoxyalkyl group, a halogenoalkyl group, or a halogeno(alkoxyalkyl) group;

5 R^2 : a perhalogenoalkyl group, or a perhalogeno(alkoxyalkyl) group;

R^3 : a group corresponding to R^1 ; and when R^1 is a group containing no hydrogen atom, it is the same group as R^1 , and when R^1 is a group containing hydrogen atoms, 10 it is a group having all of the hydrogen atoms in said group substituted by fluorine atoms.

15. The process according to Claim 14, wherein R^2 and R^3 have the same structure.

16. The process according to Claim 14, wherein a part or 15 whole of the compound (IIb-2) formed by the conversion of the compound (IVd-2) is used again for the reaction with the compound (Ia-2).

17. The process according to Claim 11, wherein the conversion reaction of the compound (IV) is a 20 decomposition reaction by heat, or a dissociation reaction carried out in a liquid phase in the presence of a nucleophile or an electrophile.

18. The process according to Claim 17, wherein the nucleophilic agent is a fluoride anion.

25 19. The process according to Claim 1, wherein the fluorination in the liquid phase is a fluorination reaction with fluorine gas carried out in a liquid phase,

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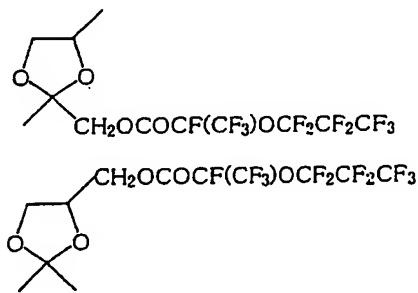
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or an electrochemical fluorination reaction.

20. The process according to Claim 1, wherein the fluorination in the liquid phase is carried out by using one member selected from the compound (IV), the compound 5 (V) and the compound (VI), as the liquid phase.

21. Any one of compounds represented by the following formulae, wherein Cy is a cyclohexyl group, and Ph is a phenyl group:

CF₃(CF₃CF₂CF₂O)CFCOOCH₂CH(OCH₂CH₂CH₃)CH₃,
 10 CF₃CF₂COOCH₂CH₂CHClCH₂Cl,
 CF₂ClCFC1CF₂COOCH₂CH₂CHClCH₂Cl,
 CF₂ClCF₂CFC1COOCH₂CH₂CHClCH₂Cl,
 CF₃(CF₃CF₂CF₂O)CFCOOCH₂CH(OCH₂CH₂CHClCH₂Cl)CH₃,
 CF₃(CF₃CF₂CF₂O)CFCOOCH₂CH(OCH₂Cy)CH₃,
 15 CF₃(CF₃CF₂CF₂O)CFCOOCH₂CH(OCH₂Ph)CH₃,
 CF₃(CF₃CF₂CF₂O)CFCOOCH₂CH(O(CH₂)₉CH₃)CH₃,
 CF₃(CF₃CF₂CF₂O)CFCOO(CH₂)₃OCH₂Ph,
 CF₃(CF₃CF₂CF₂O)CFCOO(CH₂)₃OCH₂CH=CH₂.



20 22. Any one of compounds represented by the following formulae, wherein Cy^F is a perfluorocyclohexyl group:



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$\text{CF}_3\text{CF}_2\text{COOCF}_2\text{CF}_2\text{CF}_3$,

$\text{CF}_3\text{CF}_2\text{COOCF}_2\text{CF}_2\text{CFC1CF}_2\text{Cl}$,

$\text{CF}_2\text{ClCFC1CF}_2\text{COOCF}_2\text{CF}_2\text{CFC1CF}_2\text{Cl}$,

$\text{CF}_2\text{ClCF}_2\text{CFC1COOCF}_2\text{CF}_2\text{CFC1CF}_2\text{Cl}$,

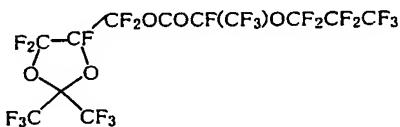
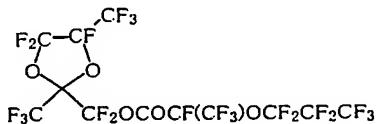
5 $\text{CF}_3(\text{CF}_3\text{CF}_2\text{CF}_2\text{O})\text{CFCOO}\text{CF}(\text{OCF}_2\text{CF}_2\text{CFC1CF}_2\text{Cl})\text{CF}_3$,

$\text{CF}_3(\text{CF}_3\text{CF}_2\text{CF}_2\text{O})\text{CFCOO}\text{CF}(\text{OCF}_2\text{CY}^F)\text{CF}_3$,

$\text{CF}_3(\text{CF}_3\text{CF}_2\text{CF}_2\text{O})\text{CFCOO}\text{CF}(\text{O}(\text{CF}_2)_9\text{CF}_3)\text{CF}_3$,

$\text{CF}_3(\text{CF}_3\text{CF}_2\text{CF}_2\text{O})\text{CFCOO}(\text{CF}_2)_3\text{OCF}_2\text{CY}^F$,

$\text{CF}_3(\text{CF}_3\text{CF}_2\text{CF}_2\text{O})\text{CFCOO}(\text{CF}_2)_3\text{OCF}_2\text{CF}_2\text{CF}_3$,



10

23. Any one of compounds represented by the following formulae:

$\text{FCOCF}(\text{O}(\text{CF}_2)_9\text{CF}_3)\text{CF}_3$

$\text{FCO}(\text{CF}_2)_2\text{OCF}_2\text{CY}^F$.

15

ABSTRACT OF THE DISCLOSURE

The invention provides a process for producing a fluorine-containing compound from an inexpensive material.

Namely, Compound I such as $R^A\text{CH}_2\text{OH}$ is reacted with
5 Compound II such as XCOR^B to form Compound III such as
 $R^A\text{CH}_2\text{OCOR}^B$, followed by fluorination in a liquid phase to
form Compound IV such as $R^{\text{AF}}\text{CF}_2\text{OCOR}^{\text{BF}}$, which is converted
to Compound V such as $R^{\text{AF}}\text{COF}$ and/or Compound VI such as
 $R^{\text{BF}}\text{COF}$. R^A is an alkyl group or the like, R^B is a
10 perhalogenoalkyl group or the like, R^{AF} and R^{BF} are
fluorinated R^A and R^B , and X is halogen.

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